SECTION 0209

INSTALLATION OF WATER LINES

0209.0100 GENERAL

0209.0101 Description of Work. The work under this Section shall consist of furnishing all labor, tools, and equipment required to install water lines, including pipe, pipe fittings, valves, and all other appurtenances in accordance with the details shown on the plans and the requirements of these specifications and any special specifications. All materials must be new and appear on the Approved Materials List (Appendix A). Where applicable, the Contractor is responsible for obtaining all permits required to complete the work.

0209.0104 Delivery, Storage, and Handling. Pipe ends shall be covered during transportation to prevent exhaust fumes from entering the pipe. Materials delivered to the site of the work in advance of their use shall be stored in a manner minimizing inconvenience to the public. Materials shall be sorted, neatly stored, and easily accessible, and shall be protected from the elements in accordance with the manufacturer's recommendations. Materials that, in the Engineer's judgment, have been improperly stored or shipped will be rejected for use in the Tucson Water System.

0209.0300 EXECUTION

0209.0301 General. Operations shall be conducted such that existing roadway facilities, utilities, railroad tracks, and other non-roadway facilities will not be damaged. The Contractor—at his/her expense—shall furnish and install sheet piling, shoring, or whatever materials necessary to adequately support material underlying such facilities or to support the facilities themselves, and shall maintain such supports until no longer needed. Temporary pavements, facilities, utilities, and installations shall also be protected until no longer required. When temporary supports and other protective means are no longer required, the Contractor shall remove and dispose of them at his/her expense.

When hauling is done over roadways or streets, the loads shall comply with legal load requirements, all material shall be removed from shelf areas of vehicles in order to eliminate spilling of material, and loads shall be watered or covered to eliminate dust. All roadway or streets used for hauling must be returned to original condition prior to final acceptance of the project.

The Contractor shall furnish and apply water for dust control, compaction purposes, and such other purposes as the project requires. The Contractor is also responsible for obtaining the proper water use permit for dust control.

All suitable material removed from excavated areas may be used instead of construction fill or borrow for backfill of trenches, and in other designated areas if approved by the Engineer.

The Contractor shall provide and maintain earthwork operations to ensure satisfactory surface drainage at all times. Ditches and other drainage facilities necessary to remove ponded water shall be constructed as soon as practical to have the work area dry during progression of work. All existing culverts and drainage systems shall be maintained in satisfactory operating condition throughout the course of work. If it is necessary to interrupt existing surface drainage, sewers, culverts, or under-drainages, then temporary drainage facilities shall be provided until permanent drainage work is complete.

0209.0302 Sequence. For pipe 24 inches in diameter or larger, the sequence of installation shall be submitted by the Contractor prior to starting work; this sequence shall include a fill strategy per Subsection 0209.0307. The sequence shall conform to the contract time and comply with all required phasing noted on the project plans. The sequence shall also minimize inconvenience to the traveling public and accommodate the requirements of the jurisdiction within whose rights-of-way the construction is occurring.

Two working days prior to commencement of excavation, the Contractor shall contact Arizona 811 (formerly Arizona Blue Stake) to verify the location of all existing utilities in the work's vicinity.

0209.0303 Layout. Layout will be done according to Section 0215.

0209.0304 Workmanship. All personnel employed by the Contractor or his/her subcontractors shall be skilled and knowledgeable regarding the installation procedures for the pipe, fittings, and appurtenances being installed.

0209.0305 Traffic Control. The Contractor shall comply with the requirements of the PAG Standard Specifications for Public Improvements.

0209.0306 Water Shutoffs and Recharging. Should construction require shutoff of the water system, the Contractor shall coordinate with the Inspector a **minimum of 14 days** prior to the planned system shutoff. The Contractor may be required to operate the necessary valves under the Inspector's direction. When operating valves under the Inspector's direction, the Contractor assumes no liability for damage to the valves during normal operation.

The Contractor shall be responsible for notifying all affected water users of the time and duration of the system shutoff. Notification shall be by information card delivered not less than 24 hours prior to the scheduled shutoff. The shutoff notification cards will be supplied by Tucson Water, with the area to be notified determined by Tucson Water. The information card shall provide a phone number at which the Contractor can be reached 24 hours a day for water users' questions and inquiries. Shutoff shall not be made during operating hours to any lines serving customers dependent on water services, unless other arrangements have been approved by the Engineer. Work involving these customers may be required at night or on weekends. Upon request, the Engineer will provide the Contractor with valve and service maps of the existing water system.

If Contractor must make an emergency turnoff because of broken pipelines, he/she must contact the Inspector and the Communications Center at (520) 791-4133 to request turnoff crew.

0209.0307 Recharging Pipeline. Filling of line shall occur after passing all required testing, and completion of backfill and installation of thrust restraints. A pre-action planning meeting will precede any line filling mains that carry large flows or operate high pressures. To avoid pipe failure, Tucson Water Representatives, the Contractor, and the Designer/Engineer will meet to prevent misunderstandings or procedures not in conformance with the plan, specifications, or design intent.

Whenever possible, Tucson Water will require filling pipelines from low to high elevations. The Contractor will avoid the use of line-sized mainline valves, and will be required to use bypass valves, blow-offs, hydrants, or other smaller connections and valves to control filling velocities to not more than 2 feet per second.

0209.0308 Pavement Removal/Replacement. Pavement removal and trenching shall be in accordance with the provisions of Section 0211 and the PAG Standard Specifications for Public Improvements.

Milled asphalt will not be allowed for backfill in the water line trench.

Pavement replacement will be done in accordance with the applicable section of the latest edition of the PAG Standard Specifications for Public Improvements.

The Contractor is also responsible for replacing “in kind” all existing pavement removed or damaged as a result of his/her operations, and that is not covered by the above specifications, regardless of ownership.

0209.0309 Trench Excavation. Trench excavation shall consist of furnishing all labor, materials, and equipment required for cutting, removal and disposal of pavement, trench excavation, and trench backfill, and shall conform to TW Standard Detail 115. Backfill material and compaction shall be in accordance with the requirements of the authority that has jurisdiction over the right-of-way. On projects where 2 or more authorities are involved, the more restrictive specification shall apply.

(A) Trenches.

(1) Longitudinal Trenches. For excavation parallel to the centerline, on roadways classified as major streets, or as otherwise required by the Engineer, the length of open trench shall not exceed 200 feet or the distance between the centerlines of adjacent cross streets, whichever is less.

For excavations occurring on minor streets or alleys, the length of open trench may be 450 feet or the length of pipe installed in one day, whichever is less. In no case, however, shall two adjacent cross streets be closed to traffic at the same time.

Should it become impossible to maintain access to private property, the property owner/occupant shall be given written notice a **minimum of 48 hours** prior to the closure of access. Access shall be restored at the end of each work day. Maintenance for open trenches, including all holes, shall comply with Subsection 0202.0101(B).

(2) Transverse Trenches. For excavations transverse to the centerline on roadways classified as major streets, trench lengths shall not exceed one-half the roadway width, unless otherwise authorized by the permitting jurisdiction. Emergency vehicle passage shall be maintained at all times.

In roadways containing median dividers, traffic will be maintained on both sides of the median, unless otherwise authorized by the permitting jurisdiction.

Minor through streets and alleys may be closed when authorized by the permitting jurisdiction. Installations in streets with a single outlet must maintain emergency vehicle access at all times.

(3) Excavated Material. Material excavated from the trench may be windrowed along the side of the trench in such a location that no collapsing soil loads are transmitted to the trench walls, and no hazard to traffic—motorist or pedestrian—is created. Excavated material shall not, in any manner, inhibit access to, or the use of, fire hydrants, driveways, or mailboxes.

(B) Unsuitable Material. Unsuitable material below the natural ground surface in fill areas, and below the finished elevation in excavation areas, shall be excavated and disposed of as directed by the Engineer.

When unsuitable material is removed and disposed of, the resulting space shall be filled with material suitable for the planned use.

(C) Surplus Material. Unless otherwise indicated on the project plans or specified in the special specifications, surplus excavated material shall be removed from the job site and disposed of by the Contractor in a manner approved by the Engineer and in accordance with the requirements found in Section 0103 of the General Provisions of the standard contract conditions (Appendix E).

Shortages of material caused by the Contractor's disposal of any material before fill quantities are satisfied shall be replaced at the Contractor's expense.

(1) Shoring and Sheeting. When trench shoring and/or sheeting is installed as necessary due to space limitations or for trench safety and/or the protection of existing adjacent above- or underground facilities, the shoring and/or sheeting shall comply with current OSHA regulations.

(2) Dewatering. Water tables shall be kept below final trench grade. Trenches shall be kept free of water for the period of time beginning prior to excavation and ending when the trench backfill is above the water table that existed prior to construction. The Contractor shall construct and maintain the necessary facilities—such as pumps, wells, drains, dams, and channels—to keep the trench free of water. If pumps are used, a minimum of one standby pump shall be on the job site. If well points are used, the Contractor must obtain the necessary dewatering permit from the Arizona Department of Water Resources.

Water removed from the site shall be conducted to drainage facilities without causing damage or disturbance to adjacent property. The Contractor shall be responsible for, and shall repair at his/her expense, any damage caused by water or protective works. Water levels shall be changed slowly and uniformly so as to not impair the stability of slopes and soil properties. No direct payment shall be made for dewatering unless otherwise specified in the special specifications.

(3) Obstructions. Should existing pipe, conduit culverts, duct banks, or other structures or obstructions not noted on the plans be encountered in the excavation and be in conflict with the proposed pipe alignment, the Engineer may approve additional excavation or direct relocation of a portion of the trench to alleviate the condition. Payment for additional excavation and backfill resulting from these changes shall be made in accordance with the provisions of Section 0103 of the General Provisions of the standard contract conditions (Appendix E). Additional payment shall not be made in cases where vertical or horizontal alignment changes are made by the Contractor for his/her convenience.

0209.0310 Bedding Material.

(A) Bedding Material Using Pipe Shade.

(1) Material. Pipe bedding material shall meet the following sieve analysis and plasticity requirements:

Table 0209-1
Bedding Material Requirements

Normal Size	Percent Passing
1 inch	100
No. 4	60 – 100
No. 200	0 – 10

The plasticity index shall not exceed 5 when tested in accordance with the AASHTO T 90.

Bedding shall be certified by an independent testing facility when delivered to the project site or by stockpile, as directed by the Project Inspector. Material the Project Inspector deems unsuitable must be recertified. All certifications are the Contractor's responsibility and are of no expense to Tucson Water. All materials must be recertified every 30 days. Copies of all certifications shall be given to the Project Inspector.

Tucson Water reserves the right to adjust these pipe bedding requirements on an individual basis to meet unexpected field/soil conditions.

All trash, forms, sheeting, bracing, and loose rock or loose earth shall be removed from the area into which bedding material is to be placed. Native material will not be allowed for use as bedding.

(2) Placement. Pipe with an inside diameter of 12 inches or less shall be installed on a minimum 4-inch thickness of bedding material. Pipe with a diameter greater than 12 inches shall be installed on a minimum 6-inch thickness of bedding material. Bedding thickness shall be measured after installation of pipe.

Bedding material shall be placed in uniform horizontal layers not exceeding 12 inches in depth before compaction. For pipe 24 inches in diameter or larger, lift thickness shall be determined by method of compaction and approved by the Engineer.

Bedding material shall be placed under, around, and over the pipe to an elevation 1 foot above the top of the pipe after compaction.

Bedding material shall be placed in a manner that will prevent distortion, damage to, or displacement of the pipe from its intended location. Bedding material shall also be placed so that adequate support will be provided in the haunch areas of the pipe. Voids or loose soils found to occur due to improper placement or compaction of bedding materials will result in rejection of that portion of the pipe installation. Replacement of the pipe will be at the Contractor's expense.

Bedding material shall be compacted to at least 90 percent of the maximum density determined in accordance with the requirements of Arizona Test Methods 225, 226, 227, 230 or 231, and 232.

If field conditions preclude jetting as a means of bedding placement, the Contractor shall submit in writing alternative methods to Tucson Water for approval.

For pipe 16 inches in diameter or greater, all bedding material shall be jetted and the Contractor shall employ a qualified testing lab to certify compliance of all bedding materials and perform all density tests. All test results shall be given to the Tucson Water Inspector and the agency with jurisdiction over the right-of-way. The Contractor is responsible for re-compaction of failed test areas.

Compaction tests shall be required of all bedding materials. Compaction tests shall be taken every 3 lifts at approximately every 500 linear feet in trenches exceeding 300 feet. The location shall be determined by the City of Tucson Water Department Construction Section Representative. In trenches less than 300 linear feet in length, the number of tests shall be as determined by Tucson Water. Compaction tests shall be included in the cost per foot of the new pipe.

Requirements for jetting select bedding material are as follows:

(a) Compaction of bedding material shall be accomplished by water jetting where free-draining soils are determined by the Engineer to exist. Bedding material to be compacted shall be leveled prior to the start of jetting operations. Water shall not be used to level the bedding material. Mechanical compaction methods are not acceptable for bedding material unless approved by the Engineer.

(b) Jetting wand should be galvanized or PVC pipe, diameter 1 to 1-1/4 inch. (Length of wand 5 feet minimum.)

(c) Water pressure shall be 50 to 80 pounds per square inch.

(d) Water source or pump shall be equipped with pressure gauge. Use of a fire hydrant as a water source will not be allowed.

(e) Water shutoff valve shall be located between supply hose and jetting wand.

(f) Lift thickness of material to be jetted shall not exceed 24 inches. In all cases, the first lift of material to be jetted shall not exceed the springline of pipe or 24 inches, whichever is smaller.

(g) The jetting wand shall be inserted to the full depth of each lift of material. Insertion and withdrawal of wand to be accomplished by slow continuous motion at intervals not exceeding 18 inches horizontal spacing.

(B) Bedding Material Using Controlled Low Strength Material (CLSM).

(1) Material. The Contractor shall proportion the CLSM to be homogenous, flowable, non-segregating, self-consolidating low-shrink slurry. Materials and proportions used shall meet the requirements of these specifications and the PAG Standard Specifications for Public Improvements, Subsections 501-2.04 and 1006-3.02.

(a) Design Strength. The unconfined compressive strength at 7 days shall be a minimum of 80 pounds per square inch and a maximum of 300 pounds per square inch. The Contractor shall form test cylinders with proposed materials to confirm design strength and mix design in accordance with ASTM D1633. Final mix approval and use of the material shall not occur prior to confirmation for strength by the cylinder breaks.

(b) Mix Design. The Contractor and his/her suppliers shall determine the materials and proportions used to meet the requirements of these specifications. The CLSM mix shall be modified as necessary to meet the flowability, pumpability, and set time requirements for each individual pour.

No CLSM shall be placed until the Engineer has issued written approval of the mix design. The Engineer's approval of the mix design shall be understood to indicate conditional acceptance. Final acceptance will be based on tests conducted on field samples and conformance with these specifications.

(2) Placement. Requirements are as follows:

(a) The pipe shall be supported above the trench floor on pea gravel bags or sandbag supports as shown on the plans.

(b) Following placement of the pipe, any unstable soil at the top of the trench that might fall into the trench during placement of the CLSM shall be removed.

(c) The Contractor shall deliver the CLSM to the trench in ready-mix trucks and utilize pumps or chutes to place the CLSM in the trench. CLSM shall be directed to one side of the pipe, with care taken not to displace the pipe at any time. The Contractor shall continue placing CLSM on side of the pipe until CLSM has gone under the pipe and up the other side to a depth of 1 foot above the pipe bottom. Handheld vibrators shall be used to continuously liquefy and move CLSM into all voids. Water in mixture shall be adjusted to maintain fluid consistency while also maintaining strength requirements. The Contractor shall

continue placing CLSM on both sides of the pipe, continuously using the vibrators for every 30 feet of pipe run.

(d) Pipe and conduit stability shall be maintained throughout CLSM placement and curing. CLSM will likely require placement in lifts to prevent pipe flotation. No movement of the pipe caused by flotation will be allowed. If any movement occurs, the Contractor shall conform with these Contract Documents at no additional cost to the Agency. All sloughed material or other debris from top of previously placed CLSM shall be removed.

(e) CLSM shall be allowed to cure a minimum of 4 hours prior to placing each lift or trench zone material. The Engineer may approve a shorter cure period if it can be demonstrated to the Engineer that the CLSM will support the individual lift or trench zone material.

(f) The Contractor shall resume backfilling operations using the techniques described above to complete the pipe zone backfill. Engineer must approve the pipe zone backfill prior to initiating the trench zone backfill.

Trench Zone: After the pipe zone backfill has been placed, compacted, tested, and approved by the Engineer, backfilling of the trench zone may proceed per Section 0205.

0209.0311 Installation.

A) General. Pipe shall be installed in conformance with the requirements specified herein and AWWA installations standards. Pipe shall be transported, unloaded, stored at the job site, and handled in a manner so as to prevent damage to the pipe. During transportation and storage, the pipe ends shall be securely covered. Any pipe section that, upon inspection, has been damaged shall be replaced by the Contractor at no additional cost to the City. Should the damage be such that the pipe can be repaired, the Contractor shall undertake repairs, to the Engineer's satisfaction, at the Contractor's sole expense.

The trench shall be excavated to the minimum width called for in TW Standard Detail 115 for the proper bedding and laying of pipe. The trench shall be excavated to a depth necessary to comply with the requirements shown on the plans and standard specifications, as well as these special provisions. All trench banks shall be as nearly vertical as practical and shall be braced by shoring or sheeting as required to protect the excavation and adjacent utilities, and to safeguard employees from cave-ins or falling rocks. The Contractor is responsible for complying with all applicable OSHA regulations.

Pipe and pipe appurtenances shall be carefully lowered into the trench by means of slings, pipe tongs, or other acceptable means. Water line materials shall not be dropped or dumped into the trench. Care shall be taken to avoid damage to the pipe coating or lining.

Water mains installed within the City Limits shall be installed with a minimum 44 inches of cover from final grade, except as otherwise noted on the approved construction drawings.

Water mains installed within existing Pima County roadways that are not at final grade shall be installed with a minimum 60 inches of cover from the future final grade, except as otherwise noted on the approved construction drawings.

The new main shall never have less than 36 inches of cover during all phases of construction.

Tracer wire shall be installed on all new pipe shown on the drawings. All costs associated with the installation of tracer wire shall be included in the unit price bid per linear foot of new transmission mains.

(B) Laying Pipe. All pipe, pipe fittings, valves, and other appurtenances shall be carefully examined for damage or other defects immediately prior to installation. Defective materials shall be legibly marked. The Contractor may initiate repairs upon the Engineer's approval. However, should the Engineer determine that repairs will not satisfactorily correct the damage or defect, the material in question shall be replaced, in kind, at the Contractor's expense.

During laying operations, no debris, tools, clothing, or other items shall be placed in the pipe.

Pipe shall be laid in reasonably close conformity with lines, grades, and dimensions shown on the project plans or as directed by the Engineer.

Pipe shall not be laid in water or when trench conditions are unsuitable for the work, as determined by the Engineer. When work is not in progress, open ends of pipe, fittings, and valves shall be securely plugged to eliminate water, earth, or other foreign material from entering the opening. Plugs shall be utility test plugs or as approved by the Engineer.

Pipe that has had the grade or joint disturbed after laying shall be removed and inspected by the Engineer to determine if it may be reused.

The new main shall never have less than 36 inches of cover during all phases of construction.

(1) Ductile Iron Pipe. Installation of ductile iron pipe shall conform to the applicable requirements of AWWA C600, AWWA M41 and the requirements of this Section. Joint assembly, including maximum joint deflection, shall conform to Section 3.4 of AWWA C600.

All ductile iron pipe—including valves and fittings—shall be encased in polyethylene in accordance with ANSI A21.599 (AWWA C105) Type A. The Contractor shall clean the pipe of all clay, mud, or other foreign material prior to installation of the polyethylene encasement. During installation, the Contractor shall take care to prevent trapping soil or bedding material between the pipe and polyethylene encasement.

The Contractor shall fit the polyethylene encasement to the contour of the pipe to effect a snug—but not tight—encasement with minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene when bridging irregular surfaces—such as bell-spigot interfaces, bolted joints, or fittings—and to prevent damage to the polyethylene during backfilling operations. Overlaps and ends shall be secured with polyethylene-compatible adhesive tape or any other material capable of holding the polyethylene in place until backfilling operations are complete.

(2) Concrete Cylinder Pipe. Installation of concrete cylinder pipe shall conform to AWWA M9 and the pipe manufacturer's recommendations, except as may be modified herein.

When bracing of the pipe or fittings is recommended by the manufacturer, the bracing shall remain in place until completion of all backfill operations. In areas where water settling is acceptable to the Engineer, bracing shall remain in place until the backfill material is sufficiently dry and able to provide adequate lateral support against deformation from transmitted loads.

(3) Polyvinyl Chloride Pipe. Installation of polyvinyl chloride (PVC) pipe shall conform to the requirements of AWWA C900, AWWA C905 and AWWA M23, except as may be modified herein.

PVC pipe bell and spigot joints shall be assembled/installed with no horizontal or vertical joint deflection and no longitudinal pipe bending. The Contractor shall use standard approved bends/fittings or a manufacturer's specifically designed gasketed joint to achieve pipe deflection. If a project requires a curved pipe alignment and fittings cannot be used to accommodate the installation of PVC, ductile iron pipe may be used. Standard ductile iron pipe joints (4 to 12 inches) are designed to accommodate up to 5 degrees in deflection.

(4) High Density Polyethylene Pipe Installation of HDPE shall conform to the requirements of AWWA C906-90 and AWWA M55.

0209.0312 Cutting of Pipe. PVC pipe shall be cut in a neat and workmanlike manner without damage to the pipe. Pipe ends shall be cut square, deburred, and beveled in accordance with the manufacturer's recommendations.

Cutting of ductile iron pipe shall conform to the requirements of Section 3.4 of AWWA C600.

Cutting of concrete cylinder pipe shall only be with the Engineer's approval.

HDPE pipe shall be cut in a neat and workmanlike manner without damage to the pipe. Pipe ends shall be cut square and deburred in accordance with the manufacturer's recommendations.

0209.0313 Connections. All material and equipment required to make a connection or tie-in shall be on the job site prior to commencement of this work. When required, equipment will include a pump with hoses.

The Contractor shall thoroughly flush existing dead-end mains prior to making the tie-in.

All existing water lines to be abandoned in place shall be cut and plugged. Cost for cut and plugging shall be included in the cost per foot of the new pipe.

0209.0314 Thrust Restraint. Thrust restraint shall conform to the requirements of Section 1406.

0209.0315 Service Connections. Unless otherwise approved in writing by the Engineer, service connections and taps shall be made prior to hydrostatic testing and in accordance with Section 1407. All new service lines shall be copper pipe per Section 1416.

0209.0316 Backfilling. Backfilling for purposes of this specification shall consist of filling the trench void from 1 foot above the top of pipe to the elevation of the lower limit of the pavement patch or other surface treatment, if not under pavement. The Contractor shall exercise due caution to prevent damage or collapse of pipe or appurtenances in the pipe zone.

The new main shall never have less than 36 inches cover during all phases of construction.

Trench backfill within the roadway of any jurisdiction shall conform to the requirements for imported material as noted herein, or as required by the jurisdictional authority, whichever is more restrictive.

Unless otherwise specified in the special specifications, the top 6 inches of the finished surface shall be compacted to a density of not less than 95 percent of the maximum of dry density as determined in accordance with the requirements of Arizona Test Methods 225, 226, 227, 230 or 231, and 232. However, the required density shall be 100 percent of the maximum density when asphaltic concrete or Portland cement concrete is to be placed directly on the finished surface.

Backfill shall be placed in uniform loose layers not exceeding 8 inches in depth before compaction, unless otherwise approved by the Engineer.

Backfill material shall be compacted to the following percentages of the maximum dry density determined in accordance with the Arizona Test Methods 225, 226, and 232:

Table 0209-2
Compaction of Backfill Material

Location	Maximum Dry Density (Percentage)
Within roadways or streets that are paved or scheduled to be paved during the next 12 months	95
Within street rights-of-ways and public easements for roadway prism of unpaved streets, alleys, and parkways that may be scheduled to vehicular traffic and not scheduled to be paved during the next 12 months	95
Alleys, easements, parkways, and areas outside the roadway	95

Jetting and water settling of trench backfill material will not be permitted within the roadway prism. Jetting and water settling of bedding and shading material is acceptable. Jetting shall be in accordance with the provisions of Subsection 0209.0310(A).

When water settling is allowed outside the roadway prism, the bedding material shall be water settled or jetted before placing backfill material.

With the Engineer's approval, trenches may be backfilled with a slurry mixture conforming to the PAG Standard Specifications for Public Improvements. Excavated material not required for backfill, or otherwise deemed unsuitable, shall be removed from the site by the Contractor at his/her sole expense.

(A) Materials.

(1) Native Material. Native material is material excavated from the trench. Native material used for trench backfill shall be free from deleterious and organic substances, chunks of clay, concrete, asphaltic concrete, asphaltic concrete millings, and debris of any nature. Prior to use as backfill material, native material shall be screened of stone larger than 6 inches in greatest dimension. No native material will be allowed for use as bedding. Asphalt in any form shall not be used in any water line trench.

(2) Imported Material. Imported material used for trench backfill shall conform to the following gradation:

Table 0209-3
Imported Material Requirements

Sieve Size	Percent Passing
6 inch	100
3/4 inch	60 – 100
No. 8	35 – 80
No. 200	0 – 12

The plasticity index shall not exceed 12 when tested in accordance with the requirements of AASHTO T 90.

Imported material used for trench backfill shall be free from deleterious and organic substances, chunks of clay, concrete, asphaltic concrete, asphaltic concrete millings, ground glass, and debris of any nature. Prior to use as backfill material, native material shall be screened of stone larger than 6 inches in greatest dimension. No native material will be allowed for use as bedding. Asphalt in any form shall not be used in any water line trench.

As an alternative to the material requirements of imported material, the Engineer may allow a slurry mixture meeting the requirements of the PAG Standard Specifications for Public Improvements.

(B) Surface Restoration and Cleanup. Any damage done to public or private property as a result of the Contractor's operations shall be restored by the Contractor at his/her expense to a condition as good as, or better than, that existing prior to construction.

(C) Utility Locations and Separations. Utility locations are shown on the plans for design purposes only. In general, the locations of major utilities, both above- and underground, are indicated on the drawings. This information has been obtained from utility maps, field survey work, and descriptions provided by the various agencies involved, and represents the best information available. The City does not guarantee the accuracy or completeness of this information, and it is to be understood that other facilities not shown on the drawings may be encountered during the course of the work.

Under State Law (Arizona Revised Statues, Title 40, Chapter 2, Article 6.3—Underground Facilities), the Contractor is required to contact all utilities in order to determine the location of existing utilities within the limits of his/her work. The Contractor is responsible for making any necessary repair to utilities damaged by his/her operation, at his/her own expense.

Water main construction shall conform to the following separation requirements with regard to other existing utility lines:

(1) Electric/Gas. Water mains shall not be installed within a 5-foot horizontal distance of parallel electric cables, conduits, or gas lines. The minimum vertical separation between electric cables, conduits, gas lines, and the water main—at any location—shall be 12 inches. Water services and fire hydrants shall not be installed at the same property corners as electrical pedestals or transformers, and shall be separated by a minimum horizontal distance of 10 feet.

When electric, telephone, cable, fiber optics, or gas facilities parallel water facilities, they shall not be installed with less than 5 feet of horizontal clearance from the water main, unless the system has been approved for "Joint-Use-Trench". If a system has been approved for joint trench, the "joint-use" trench detail must be shown on the plans.

High-pressure gas transmissions shall have vertical/horizontal separations notated on the plans or approved by the owners of each utility. Corrosion control may be necessary for installation of the water line.

(2) Storm Drain Culvert. The minimum vertical separation between the water main and storm drain culvert shall be 36 inches when the water main cannot be installed above the storm drain culvert. If minimum cover cannot be achieved when installing water mains over a storm drain culvert, the Contractor—with the Engineer's approval—may install the water main with less than the minimum cover under the following conditions:

(a) The water main material shall be ductile iron, in accordance with Tucson Water Specifications.

(b) Separation between the water main and the top of the storm drain culvert shall be no less than 12 inches, and under no circumstances shall the water line have less than 24 inches of cover (see TW Standard Detail 107).

(3) Sanitary Sewer. Water mains installed in the vicinity of sanitary sewer mains shall comply with TW Standard Detail 106. Removing and replacing existing sewer pipeline with ductile iron pipe shall be to the limits as indicated within TW Standard Detail 106 and in accordance with the current Pima County Regional Wastewater Reclamation Department (PCRWRD) Manual of Engineering Standards and Procedures, or unless otherwise shown on the drawings.

0209.0317 Temporary Highline. If a highline is required, the Contractor shall construct the highline per TW Standard Detail 375. All pipe and components shall be NSF 61 for potable water. All tie-overs to the highline will need a Tucson Water Inspector for valve isolation. The Contractor shall be responsible for protection of the highline and must make any necessary repairs to the highline to maintain service at all times while the highline is in use.

0209.0318 Testing And Chlorination. After the installation of all pipe, specified fittings, valves, hydrants, service lines, temporary highlines, and thrust restraints, the following procedure shall be followed to provide a basis of acceptance of all new work:

(A) Preliminary Flushing. Mains, hydrants, and appurtenances shall be flushed at a mean main velocity of at least 2.5 feet per second for a period of 60 seconds per 100-foot length of the section of the work being flushed. In areas where the existing system will not produce the required mean velocity, the maximum mean velocity shall be achieved for a commensurately longer duration as directed by the Engineer. All flushing water, both preliminary and final, shall be recovered for compactive or dust palliative purposes, directed to adequate surface drainage courses, or disposed of by directing it into adjacent trench backfill. In no instances shall flushing waters be allowed to pond or pool so as to cause hazards or nuisances to adjacent properties or the public.

(B) Hydrostatic Pressure Testing. Testing shall be performed in accordance with the provisions of Section 1431.

(C) Disinfection. Disinfection shall be performed in accordance with the provisions of the latest revisions of the Arizona Department of Environmental Quality Bulletin No. 8, except as modified herein.

(1) Concentrated chlorine solution shall not enter any part of the existing system. All new work, including mains, hydrants and appurtenances, shall be disinfected.

(2) The method of chlorination shall be the general continuous feed method. The tablet method of chlorination shall <u>not</u> be accepted. The chlorine concentration shall be maintained at a minimum of 50 milligrams per liter (50 ppm) of available chlorine in all portions of the new work being disinfected during the application period.

(3) The retention period shall be 24 hours. At the end of this 24-hour period, the disinfection solution shall contain not less than 10 milligrams per liter (10 ppm) of available chlorine in all portions of the new work being disinfected.

(4) Reclaimed water lines do not require disinfection.

(D) Final Flushing. At the end of the retention period, as approved by the Engineer, the heavily chlorinated disinfection solution shall be flushed from all parts of the new work through a dechlorinator.

(1) Final flushing shall be performed in accordance with the procedures described in Subsection 0209.0317(A), except that all main line valves shall be operated throughout their range and be shown to be tight closing during the final flushing.

(2) Final flushing shall continue until chlorine concentration of the flushing water discharged from all points in the new work is equivalent to the chlorine level of the flushing water supply, between the range of 0.20-1.0 milligram per liter (1 ppm).

(3) Service lines shall be thoroughly flushed prior to meter installation.

(E) Microbiological Testing. After final flushing and before the new work is accepted, microbiological tests shall be performed and shall show the absence of coliform organisms (no coliform organisms shall be detected in any samples). Once the microbiological test has been passed, tie-ins to the existing system must be made within 14 days. Failure to complete tie-ins in the specified time will require a microbiological retest. Should the retest fail, the portion or portions of the new system must be rechlorinated and a new microbiological test taken.

Microbiological testing of pipelines and production facilities shall be required. Production facility testing shall include a volatile organic compound (VOC) test.

Initial failure will require rechlorination and reflushing by the Contractor at his/her sole expense.

0209.0319 Reclaimed System Identification. Reclaimed water systems shall use purple pipe, purple marking and detecting tape, and purple tracer wire to identify all subsurface piping and fixtures, and shall also conform to the requirements of Section 0210.

All aboveground parts of the reclaimed water system, including valves, valve boxes and covers, controllers, piping, and hose bibs or other outlets, shall be identified using purple paint as specified by the standard details, plans, or as directed by the Engineer.